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15 October 2010

Ms. Demaree Collier
Remedial Project Manager
U.S. EPA, Superfund Division
77 West Jackson Boulevard, SR-6J
Chicago, Illinois 60604

Subject: Response to Secondary Review Comments Regarding the Draft Remedial Investigation Report and Risk Assessment Appendices, Matthiessen and Hegeler Zinc Company Site, LaSalle, Illinois

Dear Ms Collier:

Geosyntec Consultants (Geosyntec) is in receipt of your letter dated 8 October 2010 transmitting the review comments (secondary comments) from U.S. Environmental Protection Agency (USEPA) and Illinois Environmental Protection Agency (IEPA) to the Response to Comments letter from Geosyntec dated 3 September 2010. Attached please find our responses to those secondary comments.

Sincerely,

Richard G. Berggreen

Richard G. Berggreen, P.G.
Senior Consultant

Attachment: Response to USEPA's Secondary Comments

Cc: Kara Kelly, SulTRAC
Tom Dimond, Ice Miller

Response to U.S. EPA's Secondary Comments on Draft RI and RA

On 6 and 11 August 2010, U.S. EPA transmitted comments on the Draft Remedial Investigation (RI) and Draft Risk Assessment (RA). On 31 August 2010, Geosyntec, in consultation with SulTRAC, submitted to U.S. EPA initial responses to those comments, and on 3 September 2010, the initial responses with some supplemental responses were submitted to U.S. EPA. On 8 October 2010, U.S. EPA transmitted additional review comments on the Draft RI and Draft RA based on its review of the initial and supplemental responses. For ease of reference, U.S. EPA's additional review comments are described as "secondary comments." This document contains Geosyntec's responses to U.S. EPA's secondary comments. U.S. EPA's initial comments appear in black, followed by Geosyntec's initial and, where applicable, supplemental responses in red, followed by U.S. EPA's secondary comments in blue, followed by Geosyntec's response to the secondary comments, again in red.

SECTION 4.0 SPECIFIC COMMENTS

#29 **Section 4.1.5.1, Vertical Extent of Metal Contamination in Soil and Groundwater, Page 4-39, Paragraph 3, and Figure 4.1.5-5.** Figure 4.1.5-5 shows wells and borings up to 300 feet away from the cross-section line A-A'. The text says that this approach is "standard protocol for projecting wells onto a cross-section." However, the cross-section is not clear with the wells at the toe of the Slag Pile projected onto it. The elevation difference between the top and toe of the Slag Pile is significant. Wells located at the toe of the Slag Pile should be removed from this cross-section, and a new cross-section should be created showing these wells at the toe of the Slag Pile. In addition, the text should be revised as needed to discuss the revised cross-sections.

The comment is acknowledged. The text will be revised to include more explanation of the wells projected onto the cross sections. The extreme slope of the Slag Pile will result in apparent anomalies as a result of projection of wells off the alignment of the cross section. However, additional cross-sections will not, in our view, significantly aid readers in understanding the configuration of the slag pile, so it is not proposed to include additional cross sections. No changes to the cross sections are proposed.

Secondary Comment: All information presented in the RI report should be consistent, and if data presented on the cross section is inconsistent with data for the same information presented elsewhere in the report, such as in the boring and well construction logs, the incorrect data should be removed from the cross section.

Secondary Response: The wells at the toe of the Slag Pile (ISW-001 and ISW-002) are the wells projected onto the cross section from farthest away. Review of the text and figure indicated it was not necessary to include these wells on the cross section, and they have been removed and the text revised. This revision will remove what appeared to be the inconsistent data.

#31 **Section 4.1.5.1, Vertical Extent of Metal Contamination in Soil and Groundwater, Page 4-40, Paragraph 1, and Figure 4.1.5-7.** The text states that groundwater containing lead at concentrations above the MCL is limited to wells completely screened in the slag material. However, Figure 4.1.5-7 shows multiple wells screened in unconsolidated native media with groundwater lead concentrations above the lead MCL. The text and figure should be revised as needed to resolve this discrepancy.

The appearance of wells with lead exceedances screened in material other than the slag is the result of the projections and alignment of the cross section. The interpretation of the material in which the well is screened must be based on the boring log and well construction log. A paragraph will be added to the text regarding the projection of data onto the cross section.

Secondary Comment: All information presented in the RI report should be consistent, and if data presented on the cross section is inconsistent with data for the same information presented elsewhere in the report, such as in the boring and well construction logs, the incorrect data should be removed from the cross section.

Secondary Response: Similar to Item #29 above, the inclusion of wells ISW-001 and ISW-002 contributed to the apparent inconsistency in the interpretation of the influence of the material in which the well was screened on the water quality. These wells have been removed from the cross section and the text revised to remove this apparent inconsistency.

#32 **Section 4.1.5.1, Vertical Extent of Metal Contamination in Soil and Groundwater, Page 4-40, Paragraph 1, and Figure 4.1.5-7.** Figure 4.1.5-7 shows ISW-002 screened in the unconsolidated native media. The text states that Figure 4.1.5-7 shows ISW-002 screened in bedrock, but the figure is distorted because of the projection, and the well actually is screened in slag. If a projection causes the figure to be incorrect, then the projection should not be used. The text and figure should be revised as needed to address this issue.

The text will be revised to clarify the material in which the well is screened. Distortions which result from the projection of wells onto the cross section are unavoidable. The text is intended to provide that explanation. The cross section is not considered incorrect, but rather distorted by the projection. The text will be revised. No change to the cross section is proposed in response to this comment.

Secondary Comment: All information presented in the RI report should be consistent, and if data presented on the cross section is inconsistent with data for the same information presented elsewhere in the report, such as in the boring and well construction logs, the incorrect data should be removed from the cross section.

Secondary Response: The text and figure have been revised to remove reference to ISW-001 and ISW-002, which were projected onto the cross section and resulted in the apparent distortion and inconsistency in the cross section and text.

APPENDIX RA SECTION 2.0 SPECIFIC COMMENTS

#10 **Section 2.2.1.3; Sediment, Surface Water, and Fish Tissue; Page 2-16**: It is Illinois EPA's opinion that basing the estimate of human risk from consumption of contaminated fish on only **two** fillets is inappropriate. As part of the Illinois Fish Monitoring program, IEPA would typically collect three trophic levels of fish with each composite comprised of five individual fish. The Illinois Fish Contaminant Monitoring program procedures call for the collection of two sizes of carp, one size of catfish, and one predator (e.g. largemouth bass). Please comment accordingly.

This comment is acknowledged. The community assessment work plan proposed collecting three sportfish (each) from two community reaches adjacent to the Site (CAR001 and CAR003) and the reference location (CAR004), for a planned total of nine samples. However, due to scarcity of target-sized individuals at all community reaches, including the reference reach, the target species and number of samples at each reach were modified in the field based on availability. As noted in this comment, two fish of sufficient size were able to be filleted and utilized in the HHRA. While the limited sample size is a source of uncertainty, the use of the maximum detected fillet concentration reduces the likelihood of underestimating risk. A discussion of the uncertainty associated with the fish tissue data set will be included in the revised risk assessment; however, no other changes are proposed in response to this comment.

Secondary Comment: This concern will need to be further discussed and addressed at the Site meeting in Springfield scheduled for October 5, 2010. There may be additional comments regarding this issue after that meeting.

Secondary Response: The Final Risk Assessment will include a discussion of uncertainty associated with the fish tissue data set.

#16 **Section 2.3.2.1.1, Page 2-34, Paragraph 1.** The text states, "After employing the first tier [a default RBA of 1.0] a[t] OU1, a literature-derived arsenic bioavailability factor of 14% was developed from the primate studies of mining and smelting soils (Roberts et al. 2007)." Based on a calculation check of the OU1 exposure calculations, it appears that all numerical incidental ingestion of soil results for arsenic are based on the use of a relative bioavailability (RBA) value of 14 percent. As described in the Consensus Document (Appendix RA-1), calculations should first be performed using a default RBA value of 1.0. Then, if results are significant, site- and medium-specific RBAs can be used in follow-up calculations. The quoted text suggests that the first-tier use of a default RBA of 1.0 was conducted. However, the text does not indicate the location of these initial calculations in Appendix RA. The text should be revised to indicate where these calculations are presented.

Also, it appears that the RBA value of 14 percent has been applied to all soil and sediment calculations at the Carus Plant, Slag Pile, and LVR exposure areas. However, the studies upon which the selected RBA value are based apply to soils at smelting sites and apply most directly to soil from the Slag Pile. However, the characteristics of soil at the Carus Plant and sediment at the LVR may be different from soil at the Slag Pile. Therefore, the RBA value of 14 percent should not be applied to soil at the Carus Plant or sediment from the LVR unless it can be demonstrated that the characteristics of the soil and sediment at the Carus Plant and the LVR are sufficiently similar to soil at the Slag Pile and to the soils at smelting sites upon which the selected RBA value is based. If this demonstration cannot be made, the soil and sediment calculations at the Carus Plant and the LVR should be based on the default RBA value of 100 percent (1.0).

Finally, Section 2.3.2.1.1 should be revised to include a tie-in to the discussion of the range of RBA values (6.3 to 42 percent) calculated for OU2 (see Section 2.6.3.3) Based on this range, the use of a RBA value of 14 percent may underestimate exposures even for soils associated with smelting operations.

Subsequent discussions among some or all of USEPA, IEPA, SulTRAC and Geosyntec modified the nature of this comment and the proposed resolution. The proposed resolution is still under consideration and a more detailed response to this comment will be submitted on or before September 3, 2010.

Supplemental Response: The initial comment made essentially three points: (1) that initial human health risk assessment (HHRA) calculations should be made with a relative bioavailability (RBA) factor for arsenic of 100%; (2) that use of an alternative arsenic RBA of 14% might not be justified for Carus Plant Area soils and LVR sediments; and (3) the discussion of alternative arsenic RBA factors for OU1 should reference the range of RBA values calculated for OU2.

As to the third point, the discussion of alternate arsenic RBAs in the OU1 section will be revised to make reference to the range of RBA values calculated for OU2.

As to the first two points, in subsequent discussions several different RBA values were proposed for use at the Site or different exposure areas of the Site, including (in order from highest to lowest):

- 100%, which does not account for any chemical- or site-specific bioavailability;
- 80%, which is reported to have precedent for use at other Illinois or EPA-Region 5 sites;
- 25%, which represents the highest reported RBA from a primate study conducted with various types of soils (Roberts, et.al. 2002 cited in the Draft HHRA); and
- 14%, which represents the average RBA from a primate study conducted with mining and smelting soils (Roberts, et.al. 2007, also cited in the Draft HHRA).

While the Consensus Document proposed use of 100% as the Tier I RBA, presentation of HHRA results for both an arsenic RBA of 100% and 80% for every risk scenario across OU1 and OU2 will involve a significant amount of work for no material benefit in decision-making. The differences in risk assessment results based on the two RBAs are unlikely to result in any materially different conclusions, and presenting all the HHRA results with both RBAs is likely to be confusing. Based on subsequent discussions, we understand that EPA agrees that an arsenic RBA of 80% should be used as the Tier I arsenic RBA for use in the HHRA.

The initial comment from EPA agreed that 14% was an appropriate arsenic-RBA for the Slag Pile Area based on the references cited in the Draft HHRA. For the reasons set forth in the Draft HHRA and summarized in the paragraph below, we believe that the arsenic RBA of 14% is fully supported for use in the Slag Pile Area. Therefore, 80% will be used as the Tier I arsenic RBA in the RAGS Part D Tables for all other risk scenarios at OU1 and OU2, but 14% will be used as the Tier I arsenic RBA for the Slag Pile Area. RAGS Part D Tables using an arsenic RBA of 80% for the Slag Pile Area will be provided in the uncertainty section, and the impacts to the risk characterization will be evaluated through a comparison of the results.

We do not believe the arsenic RBA factor of 80% is based on appropriate scientific support and has limited site-specific relevance, whereas the use of a lower RBA for arsenic across the Site is supported by the literature and site-specific information. As described in the Draft HHRA, primate studies conducted by Roberts, et.al. (2002) utilizing a variety of soil types determined that an oral bioavailability factor of 25% is "the upper bound value to represent soil arsenic bioavailability." Subsequent studies specific to smelter and mining soils showed bioavailability results ranging from 5 to 19% with an average RBA of 14% (Roberts, et.al. 2007). Given that primate study results using the smelter soil most closely related to the site soils showed lowest bioavailability (5%) and the sequential extraction results detailed in the RI report show that arsenic is tightly bound to Site soils, use of a 14% RBA for arsenic should represent a conservative assumption in the risk assessment. The RBA of 14% is also within the range of site-specific bioaccessibility studies performed with OU2 soils. Thus, the use of an 80% arsenic RBA likely overestimates risks for the Site, and in particular, at the Slag Pile Area would result in an inaccurate portrayal of risks.

Secondary Comment: Consistent with the approved Consensus Document and EPA's "Guidance for Evaluating the Oral Bioavailability of Metals in Soils for Use in Human Health Risk Assessment" (EPA 2007), the Tier 1 arsenic RBA should be 100 percent for all OU1 and OU2 exposure areas. However, it is agreed that the numerical difference in results between calculations using arsenic RBA values of 100 percent and 80 percent is not large. Therefore, documentation of the Tier 1 calculations using an arsenic RBA of 100 percent may be in the form of a summary table. Again, consistent with the approved Consensus Document and EPA (2007), subsequent or Tier 2 calculations for all exposure areas should be performed using a "default medium-specific RBA" unless "site-specific, medium-specific RBA results are available." For arsenic, the default RBA for soil is considered to be 80 percent. This value is incorporated into Illinois EPA's "Tiered Approach to Corrective Action Objectives" (TACO) (IPCB 2007) and is consistent with default arsenic RBA values used at other Region 5 sites. For example, at the South Minneapolis Residential Soil Contamination Site, a BRA in soil of 90 percent was assumed due to the lack of site-specific bioavailability information. Although some information may be available suggesting that a site-specific RBA for arsenic in soil may be lower than 80 percent, the available information does not in itself adequately justify the use of a site-specific arsenic RBA for the Slag Pile Area. Therefore, the default arsenic RBA for soil of 80 percent must be used for all exposure areas, including the Slag Pile Area unless site-specific RBA studies are performed and site-specific RBA percentages are generated.

As stated in the response, the discussion of alternate arsenic RBAs in the OU1 uncertainty section will be revised to refer to the range of RBA values calculated for OU2. Additionally, the basis for and impact of a still lower arsenic RBA (such as the proposed value of 14 percent presented in the response) can be presented and discussed as part of the uncertainty section.

Secondary Response: The Final Risk Assessment will include a table that summarizes the risk calculation results based on an arsenic RBA of 100 percent (Tier 1). The risk calculations presented in the RAGS Part D Tables will be based on an arsenic RBA of 80 percent (Tier 2). Finally, the uncertainty section for the OU1 Slag Pile Area will present a qualitative and quantitative discussion of the impacts of a lower (e.g., 14%) RBA for arsenic.

#17 **<u>Section 2.3.2.4, Page 2.45, Paragraph 1</u>.** The text states that chemical speciation data was not collected from fish tissue samples collected from the LVR to assess the form of arsenic. However, the text goes on to discuss how the fraction of arsenic likely is present in the organic chemical arsenobetaine and that the fraction of inorganic arsenic (the form upon which the toxicity factors used in the risk assessment are based) is expected to be 27 percent or less. Section 2.6.2.6.1 states that a value of 10 percent was selected as the percentage of inorganic arsenic in the fish fillet data. The text should be revised to clarify that the exposure calculations presented in the OU1 Risk Assessment Guidance for Superfund (RAGS) Table 7s (Appendix RA-G1) were initially performed assuming 100 percent inorganic arsenic. Any alternate percentage should be presented consistently throughout the risk assessment (Sections 2.3.2.4 and 2.6.2.6.1 should be consistent) and any additional calculations based on this alternate percentage should be presented as part of the uncertainty discussion, unless and until site-specific arsenic speciation results are available.

Subsequent discussions among some or all of USEPA, IEPA, SulTRAC and Geosyntec modified the nature of this comment and the proposed resolution. The proposed resolution is still under consideration and a more detailed response to this comment will be submitted on or before September 3, 2010.

Supplemental Response: As discussed at the 19 August 2010 meeting between Geosyntec, SulTRAC, EPA, Illinois EPA and Illinois DNR, the percentage inorganic arsenic assumed in fish is derived from an EPA Technical Report (*Technical Summary of Information Available on the Bioaccumulation of Arsenic in Aquatic Organisms, Office of Water, EPA-822-R-03-032, Dec. 2003*). Based on the follow-up discussions with EPA, we have included the 10% inorganic arsenic percentage in fish in the RAGS-D Tables and will include in the uncertainty analysis a discussion of the impacts of this assumption on risk.

Secondary Comment: The response states "the percentage of inorganic arsenic assumed in fish is derived from an EPA Technical Report (*Technical Summary of Information Available on the Bioaccumulation of Arsenic in Aquatic Organisms, Office of Water, EPA-822-R-03-032, Dec. 2003*)." However, the response does not state that Section 2.3.2.4 will be revised to include this information. Section 2.3.2.4 should be revised to clearly identify the source of the information presented to support the selection of a value of 10 percent inorganic arsenic in fish tissue. The remainder of the response is acceptable.

Secondary Response: Agreed. Section 2.3.2.4 will be revised to include the above-referenced source.

APPENDIX RA – DRAFT RISK ASSESSMENT

#3 **3.1.1.1.2 Slag Pile.** Pioneering vegetation (not understory) includes bladder-campion (*Silene vulgaris*) and an unidentified sedge (*Carex* spp.). It should be noted that "the seeds of sedges … are eaten by many kinds of wildlife" including songbirds (especially sparrows), upland gamebirds (grouse), rails, ducks, and chipmunks; and foliage is browsed by deer (Martin, et al. 1951). In other words, sedges provide an exposure pathway to wildlife at an early stage of vegetative establishment on the slag pile.

Martin, A., H. Zim and A. Nelson. 1951. American Wildlife & Plants, A Guide to Wildlife Food Habits. reprinted 1961. Dover Publ., New York. 500 p.

Field sparrows (*Spizella pusilla*) also inhabit the site, and feed on a mix of seeds and invertebrates.

The comment is acknowledged. Plants will be included in the SLERA CSM, and the presence of vegetation on the Slag Pile is already acknowledged in the conclusions of the SLERA. Therefore, no changes are proposed in response to this comment.

Secondary Comment: USEPA is requesting for the on-site plant and animal lists to be updated to include the 2 plant and 1 bird species USEPA observed that are not in the draft list, and an acknowledgment that foodchain exposures can occur on the sparsely vegetated slag pile.

Secondary Response: The first paragraph of Section 3.1.1.1.2 will be modified to make reference to the 2 plant and 1 bird species observed by USEPA and also to reference the possible foodchain exposures on the sparsely vegetated portion of the slag pile. The three species noted above will also be included in the tabulated list of species requested by IEPA.

#10 **4.1.2.2.2 Study Design for Evaluating AE3 and AE4.**

<u>*Receptor Exposure Assumptions*</u>. See comments on Table RA-G4-4. Mink area use factor is underestimated, and the sediment ingestion of the surrogate species for kingfisher is incorrectly reported.

Toxicity Reference Values. The approach for deriving LOAEL TRVs is inconsistent with the intent of the EcoSSL approach for deriving NOAEL TRVs. For the EcoSSLs, the NOAEL TRV is first calculated at the geometric mean of NOAELs from accepted studies. This is a conservative approach because it ensures that the NOAEL TRV will be *lower* than the highest NOAEL in the data base. In a second step, the geometric mean NOAEL will not be selected for the EcoSSL if it is higher than a bounded LOAEL in the toxicity data base (a bounded LOAEL is from a single study reporting both NOAEL and LOAEL values). In other words, if a bounded LOAEL is lower than the geometric mean NOAEL, EcoSSL discards the geometric mean NOAEL as insufficiently protective, and replaces it with a lower and more conservative value that does not exceed *any* bounded LOAEL from accepted studies.

The BERA approach of taking the geometric mean of LOAELs is non-conservative because it ensures that the LOAEL TRV will always be *higher* than the lowest LOAEL values. The geometric mean LOAEL approach is also non-conservative compared to the species sensitivity distribution (SSD) approach for deriving TRVs from synoptic toxicity data. Usually, TRVs based on SSDs are calculated to be protective of 95 % of species, which will always result in a lower value than the geometric mean of the same data set.

Aside from being inherently non-conservative, a secondary issue with this approach is the uncertainty of combining unbounded and bounded LOAELs in the calculation.

The geometric LOAEL TRVs should be replaced with either SSD-derived TRVs protective of 95 % of species, or with the lowest LOAEL from an appropriate study.

An additional point is that the EcoSSL study summaries are secondary literature, and, like all secondary literature, the data cannot be assumed to be 100 % accurate. The original studies for the TRVs that drive important remedial decisions at the site should be reviewed.

Subsequent discussions among some or all of USEPA, IEPA, SulTRAC and Geosyntec modified the nature of this comment and the proposed resolution. The proposed resolution is still under consideration and a more detailed response to this comment will be submitted on or before September 3, 2010.

Supplemental Response: As to the Receptor Exposure Assumption portion of the comment, the sediment ingestion rate of 2% for the surrogate species (mallard duck) for the kingfisher was obtained from the Table 4-4 of the WEFH (USEPA, 1993), and the reference will be revised accordingly.

As to the mink area use factor (AUF) portion of the comment, the likely size of the mink home range relative to the riparian corridor along the LVR was discussed between Geosyntec and EPA. EPA's position is that an AUF of 1 should be used to compute risk associated with the mink at the Site. In our view, this position is not consistent with the scientific literature or the characteristics of this Site. The riparian corridor along the LVR offers marginal mink habitat (Loukmas and Halbrook, Wildlife Society Bulletin v29, pp821-6). No mink sightings or signs of mink foraging have been observed at the site. Mink population density is inversely related to the quality of the habitat. Several of the mink population density and home range studies cited in the Wildlife Exposure Factors Handbook (WEFH; USEPA, 1993) are conducted in areas with abundant food sources and higher quality mink habitat (coastal estuarine systems). This may bias those studies high relative to our site conditions. In the Arnold and Fritzell (1987) paper the study area offers a more limited selection of aquatic prey and therefore the mink show a greater foraging range. We believe this paper, cited in the WEFH, provides the best representation of the mink home range relative to the LVR. Thus, the AUF used in the Draft HHRA (0.4) had a strong scientific foundation given the characteristics of the LVR and this Site and is believed to be appropriate. We have reluctantly agreed to recalculate the mink risks using an AUF of 1 for the final risk assessment, and will present information on the impact of this assumption in the uncertainty section.

As to the Toxicity Reference Value portion of the comment, subsequent discussions among the ecological risk assessment representatives of the stakeholders resulted in an agreement to use the Region 9 BTAG high TRVs as the LOAEL TRVs in the final BERA.

While agreement has been reached, we disagree that the methodology explained and approved in the Consensus Document is inconsistent with the EcoSSL approach or is not conservative. These statements in the comment and the alternative calculation methods suggested imply that the lowest LOAEL results reported in the EcoSSL study have greater validity than higher results. Given that all the individual study results included in the EcoSSL tables were identified by EPA (after a multi-stakeholder review process) as appropriate for deriving wildlife TRVs, we have no basis to give greater weight to the lowest LOAEL results reported in EcoSSL tables. Toxicity studies based on different species, dosing routes, chemical forms, and test conditions can be extremely variable. No one result in an array of such data is inherently more reliable than another. EPA compiled the EcoSSL documents so that ecological risk decisions could be made on a broad array of available data rather than on single points that are inherently subject to variability and study error. Deriving LOAEL TRVs based on a single study or a judgmentally selected group of studies suffers from the deficiency that it discards data that EPA has deemed reliable. In addition, use of the geometric mean of the EcoSSL LOAEL values has been used to derive LOAEL TRVs at other sites. See e.g. Final Screening-Level Ecological Risk Assessment Work Plan for Phase IV Remedial Investigation/Feasibility Study at the Former Lake Ontario Ordnance Works, Addendum to the Screening-Level Ecological Risk Assessment at Selected Exposure Units, June 2009, Table 3.1 and notes on p. 24, available at http://www.lrb.usace.army.mil/derpfuds/loow/loow-phase4ri-slerawp-redacted-2009-06.pdf). For these reasons, we believe use of the geometric mean is a preferable and appropriately conservative approach for calculating the LOAEL TRVs. Since use of the Region 9 BTAG High TRV values as the LOAEL TRVs for this Site has been accepted, we have included this paragraph simply to respond to the comment.

Secondary Comment: There are questionable statements in the supplemental response that will be contested if they are included in the uncertainty section. (May also apply to #13).

Secondary Response: It is understood that there is some disagreement as to some of the issues raised in U.S. EPA's initial comments, but agreement has been reached on the inputs to be used in the Final BERA in relation to all these issues. The Final BERA will utilize the following inputs per the supplemental response above:

- A sediment ingestion rate of 2%, based on a surrogate species (mallard duck), will be used to calculate the belted kingfisher's average daily dose. The reference will be revised to indicate the source of this value, which is Table 4-4 of the USEPA Wildlife Exposure Factors Handbook (1993).

- An AUF of 1 will be used to calculate the mink's average daily dose. The uncertainty section will include a qualitative discussion of an alternative AUF.

- The Region 9 BTAG high TRVs will be used as the LOAEL TRVs. The uncertainty section will include a general discussion of uncertainty associated with the Region 9 BTAG high TRVs, but will not include alternative calculations based on the approach to calculating LOAEL TRVs used in the Draft BERA.

Based on these agreed inputs, the Final BERA should not include any statements that U.S. EPA deems questionable.

#11 **4.1.5.2 AE2 – Function and Viability of the Fish Community.** Fish abundance is depressed in sample reaches near the site. Based on catch per unit effort (CPUE), Reaches CAR002 and CAR003 have only about one-third of the abundance of fish in Reference Reach CAR004. The pronounced reduction in fish abundance is a line of evidence of ecological impairment near the site.

Abundance is just one measure of the fish community structure that; taken in isolation can be misleading with regard to community impairments. Fish distribution can be clustered (e.g., a school of minnows), and a random hit or miss of one of these schools when sampling can have a great influence on measured abundance. In the case of the LVR assessment, the number of individuals varied from 172 at the upstream (in-stream) reference location (CAR004) to 61 at the location (CAR003) on the upstream edge of the slag pile, to 53 at the next location downstream along the slag pile (CAR002) and 107 at the most downstream location, also along the slag pile (CAR001). The greater measured abundance of just two species, Northern hog sucker and bluntnose minnow, are largely responsible for the greater measured abundance at the reference location (CAR004) compared to the slag pile/CSO site (CAR003) and slag pile sites (CAR002 & CAR001). In the case of bluntnose minnow, only two individuals were collected at the three downstream stations, while 52 specimens were collected at CAR004, and these were collected as a school. Electrofishing sampling efficiency was greater at CAR004 because the reach was more wadeable than the other reaches. The downstream reaches had more areas with deeper, faster flowing conditions, which negatively impacted sampling efficiency. There was also more aquatic vegetation associated with CAR004, which creates quiescent areas attractive to bluntnose minnow.

Because measures of abundance can be affected by sample collection techniques, associated sampling efficiency, habitat influences, and fish behavioral and distribution patterns, fish abundance alone is not a sensitive measure of impairment or enhancement of the fish community.

As an example of how fish abundance alone provides an incomplete picture of community status, consider species diversity. Certainly there is consensus that greater species diversity is a positive fish community attribute. Diversity indices provide more information about community composition and take the relative abundances of different species into account as well as species richness (i.e., number of individual species). The Shannon-Wiener[1] diversity index (H′) is an index that is commonly used to characterize species diversity in a community accounting for both abundance and evenness of the species present (how equal the community is numerically). The index is increased either by having additional unique species or by having greater species evenness. Calculated Shannon-Wiener diversity indices (H′) for each LVR sampling location are 2.18 (CAR004), 2.31 (CAR003), 2.24 (CAR002), and 2.08 (CAR001). Thus, when considering measured fish abundance and the evenness of the species present, there is little difference in species diversity among the sampled reaches. However, note that the slag pile/CSO reach, CAR003, and slag pile reach, CAR002, have greater species diversity than the reference reach, CAR004. But again, though the Shannon-Wiener index incorporates two attributes of the fish community (abundance and species

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[1] Levinton, J.S. 1982. Marine Ecology. Prentice-Hall, Inc. Englewood Cliffs, NJ. 526 pp.

evenness), this single index alone is still not a fully reliable measure of fish community impairment.

The fact that single measures of the fish community are unreliable in determining impairment status is the founding basis for development of the multi-metric assessment approach upon which Indices of Biological Integrity (IBIs) are based. In the case of the IDNR IBI protocols, which (as for most states) were developed using EPA protocols, fish abundance is not included as one the 10 metrics used to objectively and defensibly assess fish community impairment status in support of Clean Water Act goals (i.e., Section 303(d)). Based on assessment of LVR fish and macroinvertebrate communities using established IBI protocols, the reach of river along the slag pile is fully supporting designated aquatic life uses in accordance with Clean Water Act goals. This finding presents the more compelling line of evidence with regard to ecological impairment near the site.

No revision to the report text is anticipated.

Secondary Comment: Reduced fish abundance has been reported at other metals sites. This concern will need to be further discussed and addressed at the Site meeting in Springfield scheduled for October 5, 2010. There may be additional comments regarding this issue after that meeting.

Secondary Response: The secondary comment is being addressed based on the discussions among U.S. EPA, Illinois EPA, SulTRAC and Geosyntec at the 5 October 2010 meeting in Springfield. Based on those discussions, additional analyses of the fish data are being conducted and a revised Biological Assessment Report will be submitted for additional review and comment. Once the Biological Assessment Report is finalized and approved, its conclusions will be incorporated into the Final BERA.

#16 **Appendix RA-E-S3 OU2 ERA Tables.** Soil ingestion rates should be calculated as a fraction of dry-weight food ingestion, not wet-weight food ingestion. The soil-based exposures are overestimated.

Total food ingestion should not be adjusted to account for the soil ingestion component, that is, the total food components should sum to 100 %, and the soil ingestion component added above and beyond. The reason is because the Nagy (2001) regressions for food ingestion are calculated from regressions for field metabolic rate (Nagy, et al. 1999). FMRs are based on the energetics of free-ranging animals, which are converted to food ingestion rates by dividing by the metabolisable energy content of the diet. The food ingestion rates generated by this method are the amounts of food required to provide for the energy used by the field metabolic rate. The calculation does not include extraneous components of the diet, such as soil or sediment, that do not contribute calories. The food-based exposures are underestimated by inappropriately forcing the combined dietary and soil components to sum to 100 %.

Nagy, K., I. Girard, and T. Brown. 1999. Energetics of free-ranging mammals, reptiles, and birds. Ann Rev Nutr 19: 247-77.

Soil ingestion rates in the draft RA-E-S3 OU2 ERA tables were calculated as a fraction of dry-weight food ingestion rather than wet-weight food ingestion.

Total food ingestion was not adjusted to account for the soil ingestion component in the draft risk assessment. The soil ingestion component was added above and beyond the total food component of 100 percent.

Secondary Comment: In Tables RA-E-S3-1 through RA-E-S3-9 the ingestion rates of dietary items and soil sum to 100% of the food ingestion rate according to the table notes. As discussed in the original comment, this is inconsistent with the source of the food ingestion rate. The ingestion rates of dietary items should sum to 100% of the food ingestion rate, and the overall sum including the soil ingestion rate should be greater than 100% of the food ingestion rate.

Secondary Response: The secondary comment relates to tables prepared by SulTRAC as part of the Draft BERA for OU2. Accordingly, SulTRAC will need to respond to the secondary comment.

APPENDIX RA-G1 GENERAL COMMENTS

#2 The footnotes in the RAGS Table 3s indicate that calculation of the mean for samples with detected and censored results used surrogate values equal to one-half the reporting limit (RL) for the censored data. Use of simple substitution is not recommended in these cases, and it is suggested that the Kaplan-Meier means from the ProUCL output are a more appropriate estimation method. The RAGS D Table 3s should be revised accordingly.

This comment is acknowledged. However, there is uncertainty associated with both methods for calculating the mean. Given the high frequency of detection for the majority of constituents (i.e., metals), the calculation method is unlikely to significantly affect the resultant mean value. Moreover, with the exception of the evaluation of lead, mean concentrations were not utilized in the risk assessment. Therefore, no changes are proposed in response to this comment.

Secondary Comment: This response is accepted with the following exception. The OU1 uncertainty discussion should be revised to discuss the impact of the use of the simple substitution method rather than the Kaplan-Meier method on the calculated means, particularly for lead.

Secondary Response: Agreed. The uncertainty section will discuss the impacts of the use of the simple substitution method rather than the Kaplan-Meier method to calculate average concentrations of lead.